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This is the final report of our intervention study that aimed to increase the use of breast cancer screening among older single African-American women. During the period, we finished each task for the project according to the Statement of Work. We developed a breast screening intervention program according to socioeconomic, cultural, psychological and behavioral characteristics of older single African-American women, conducted the intervention, completed three waves of interviews, and did data analyses to evaluate the intervention program. Our study subjects were single African-American women aged 65 and older living in ten public housing complexes. The intervention program targeted cognitive barriers, psychological barriers related to single marital status, and social-network barriers. Our preliminary results based on the mixed model regression analysis showed that women in the intervention group seemed more likely to have a clinical breast examination or mammogram in the first year after the intervention. The intervention program did not have the overall positive effects on breast self-examination and knowledge/attitudes/beliefs in breast health and screening. These preliminary results were discussed while more detailed data analyses are needed to further evaluate the intervention program.				
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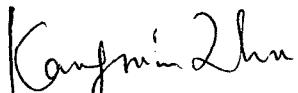
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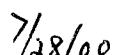
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INTRODUCTION

This is the final report of our research project entitled "An Intervention Study on Screening for Breast Cancer among Single African-American Women Aged 65 and Older". According to the Statement of Work, this project should be completed in July, 2000. We have finished the project as scheduled. During the study period, we did each task specified in the Statement of Work. We conducted the interventions, completed three waves of interviews, and did some data analyses to evaluate the intervention program. We have had some accomplished or forthcoming publications and some accomplished or forthcoming presentations based on our pre-intervention data. In our previous annual reports, we summarized our work according to technical objectives 1-3. In this final report, we report our work for technical objectives 4-5 (evaluation of the intervention program and the maintenance of intervention effects) and present our preliminary results on the evaluation.

BODY

Introduction

About one-half of the deaths from breast cancer occur in women older than 65 years [1,2]. Although the effectiveness of breast cancer screening on decreasing mortality of the disease has been well demonstrated [3,4], regular breast cancer screening procedures are underused among older women [1,5], especially older African-American women [6,7]. The underuse is related to cognition-related, economy-related, social-support-related and medical care-related barriers to breast screening, including lack of knowledge and incorrect beliefs and attitude [8-10], poverty

[11], lack of social support [6] and lack of physician's recommendation [1,11].

For single older African-American women, single marital status may bring about additional barriers to breast cancer screening in addition to the barriers related to older age and African ethnicity. This may be due to (1) lack of support and help from spouse in spirits and routine life, (2) fewer economic resources [12], (3) distress and depression [13,14], because of loneliness due to loss of the spouse, and (4) less interactions with their social network [12] and less social support as a result of restricted physical mobility, loss of the spouse and the withdrawal from previous social relations. Therefore, older single African-American women may be less motivated, advised, and helped to seek a breast screening.

Intervention programs targeting ethnic and cultural background, economic and education level, and social connections may be important for improving people's behavior in seeking preventive care. However, only a few intervention studies have been conducted on increasing breast cancer screening in African-American women aged 65 and older. Roberson [7] reported a community-based intervention study among African-American women ages 65 and older in Erie County, New York. The interventions included a mobile van to provide women free breast self-examination instruction and clinical breast examination in their neighborhood. Reminder messages, transportation and material incentives were provided for women's participation. The results showed that participation in a breast health education program and clinical breast examination was high, but completion of screening mammography provided in a local hospital was low. A nurse practitioner quasi-intervention was developed to increase breast cancer screening among African-American women aged 65 years or older in two hospitals in New York city [15]. At post-intervention, women in the intervention hospital, where nurse practitioners

provided breast screening during the routine visit, were twice likely to have had a mammogram than those in the control hospital.

Where interventions specifically directed at African-American women aged 65 and older have been limited, no studies have targeted single older African-American women. Since 75% of African-American women aged 65 and older were single (widowed, divorced, separated and never-married) [16], increasing the screening among older single African-American women is of special importance for early detecting breast cancer and increasing the survival of breast cancer patients among African-American women. It is imperative to develop an intervention program according to the characteristics of older single African-American women. This study aimed to develop and evaluate a multi-component intervention program on breast cancer screening among single African-American women ages 65 and older living in public housing complexes, based on the theoretical model we established.

Materials And Methods

1. Study Design

This study used a community-based intervention study design. We randomly assigned public housing complexes into an intervention or control group. An intervention program was conducted in the intervention group. Data were collected at three time points: pre-intervention, post-intervention (one year after the intervention) and follow-up (one year after the post-intervention assessment).

2. Study Subjects

The study was conducted in public housing complexes administered by Metropolitan Development and Housing Agency (MDHA), Nashville, Tennessee. The primary purpose of developing public housing projects has been to provide decent, safe, and sanitary housing for low-income citizens of Nashville-Davidson County. Average annual income for the ten housing complexes of the study ranged \$5,192-\$7,439 in 1997.

Study subjects were single African-American women ages 65 and older living in ten public housing complexes. The single was defined as those who were divorced, widowed, separated and never-married in the preceding year of the study. Before the onset of the study, MDHA provided the research team a list of addresses of all African-American ages 65 and older. Door-to-door canvassing strategy was taken to identify the eligible women and to recruit them for the study. The door-to-door canvassing was conducted by a female study helper (see below) identified from the neighborhood and a female research interviewer who were African-American. The advantages for the involvement of a study helper at this initial stage were threefold: (1) increasing the participation of eligible women because of their greater trust when a woman from their neighborhood was present, (2) implementing intervention (see below) simultaneously if a subject was available then, and (3) safety considerations. With a letter from the resident association coordinator of MDHA and a letter from the principal investigator, the study helper and the research interviewer visited each address to identify eligible women according to ethnicity, age, marital status and history of breast cancer. If a woman was eligible, the interviewer further introduced the study and its procedures, mentioned monetary incentive of \$25 for a completed interview and obtained the woman's consent to participate in the study. For an eligible woman

who was willing to participate and signed the consent form, an in-person interview was conducted immediately if she was available at the visit or scheduled if she was not available then. If an individual at the address was not home at the visit, subsequent visits were made to identify the eligibility. The same efforts were made to complete an interview for a woman who was not home at a scheduled time. Considering that some refusals might result from the fact that a woman might be doing something (such as watching TV) or was not in a good mood that she did not want an interview at that time, we visited refusing women again at another time. Three hundred and sixty-seven eligible women identified and 325 were interviewed at pre-intervention (88.6% of eligible women). Two hundred and eighty-eight and 255 women were interviewed at post-intervention and follow-up respectively.

3. Data Collection

Using structured questionnaires, in-person interviews were conducted at pre-intervention, post-intervention and follow-up for data collection. Interviewers were trained in interviewing/recording/editing skills, introducing the questionnaire, defining/clarifying questions and answers, and mimicking interview process. Other issues for a good interview and communication with women, such as interviewer's appearance, ways to approach women, introduction remarks, ways to deal with difficult situations and so on, were also addressed.

Information collected included:

- Demographic variables: age, ever married or lived-as-married status, marital status in the past year, educational level, household income, and religion preference;
- Use of breast cancer screening procedures: Ever use and use frequency of clinical breast examination, mammography and breast self-examination;

- Social and familial factors: Number of children, grandchildren, close relatives and close friends; frequency of telephone calling the children/grandchildren, relatives or friends, willingness of the children/grandchildren, relatives or friends to provide financial help or care when needed; frequency of attending social activities; going shopping and going to religious places;
- Medical care factors: Having a medical insurance, a regular medical facility, and a regular doctor; distance between home and the regular medical facility; availability of transportation for visiting a doctor; seeing a doctor regularly; and the regular doctor's or other doctors' recommendations for a mammogram;
- Knowledge, attitudes and beliefs on breast health: usefulness of mammograms, need of a mammogram without a breast problem, possibility of having breast cancer without symptoms, curability of breast cancer if caught early, screening for breast cancer making women worry, treatment worse than the disease, spread of cancer by an operation, concerns on cost/radiation/discomfort due to mammography, fear of finding cancer, stopping having a mammogram due to the concerns, likelihood to get a mammogram next year, risk of getting breast cancer, information about breast health through media or from family members/relatives/friends, and meeting attended or educational materials received last year;
- History of benign breast disease and history of breast cancer in relatives (mother, daughter and sisters) and friends;
- Emotional and psychological symptoms and signs: sad or blue, poor appetite, weight loss/gain, trouble falling asleep, sleeping too much, loss of energy, easily fatigued, feeling tired, loss of interest or pleasure, feeling guilty or down, feeling worthless, feeling lonely, irrational fear of illness, poor concentration, slowing of thinking, trouble

making decisions, being unable to sit still, slowing down physically, and thoughts of ending life.

Questions about help and communications from the significant others were also asked for a woman in intervention group to examine whether her significant others had actually implemented their obligations as we advised in our interventions. We also inquired the changes in marital status in the past year to adjust for the possible effects of the changes in data analysis.

4. Intervention program

4.1. Theoretical starting points

We established our intervention program based on the following theoretical starting points:

(1) The intervention program should consider the characteristics of single marital status of older women. Emotional problems may be prevalent among older single women. One may not improve her health-related behavior without relief of emotional problems, as demonstrated that efforts on increasing intrinsic motivation for seeking health care will not be successful unless the elders' sense of well-being is positive [17]. Lack of support from the spouse further impedes a woman's health-care-seeking behavior. Therefore, the intervention program should contain multiple components including those in psychology and social support. A study showed that African-American women prefer multipurpose programs that help them with several needs [18].

(2) Intervention should take into account the characteristics of African-American ethnicity of older women. Because beliefs and behaviors of the black elderly are influenced by their culture

and class [7], development and delivery of educational interventions should consider cultural and classic factors. Since older African-American women are more involved in a mutual assistance system among family members [7] and more reliant on relatives and friends for support [19] compared to their white contemporaries, support from family members or friends may be more effective in improvement of older African-American women's screening behavior.

Based on these theoretical starting points, we established a theoretic model that was directed at three intervention aspects: cognitive barriers, psychological barriers related to single status, and social-network barriers. We considered cultural, social, physical and psychological characteristics of African-American ethnicity, older age and single marital status in the development of intervention instruments and the implementation of interventions.

4.2. Intervention components and their theoretical bases

4.2.1. Interventions on cognitive barriers

The theoretical points of interventions on cognitive barriers basically came from Health Belief Model and Precede-Proceed Model. According to Health Belief Model, people usually seek health screening after they recognize susceptibility to the particular disease, severity of its consequences, feasibility and efficaciousness of the advocated health behavior, rectify misunderstanding on perceived negative aspects of a health action, and generate concern for their health [20,21]. Therefore, a person's action depends upon his/her knowledge, attitudes, beliefs, and perceptions, which are defined as predisposing factors in Precede-Proceed Model [22,23]. By improving a woman's knowledge, attitudes, beliefs and perceptions, we expected to reduce

barriers on these predisposing factors, and therefore increase women's perceptions of being at risk for breast cancer and the benefits of breast cancer screening. According to Health Belief Model, desirable health-care-seeking behavior might follow as a result of the interventions.

Cognition is related to ethnic background and socioeconomic characteristics [20], and therefore, cognitive interventions should consider features of African-American women. Beliefs and knowledge are key predictors of breast screening behavior among African-American women [7,24]. In addition, fear of finding cancer and fatalistic view of cancer as barriers to screening are also especially important for low-income African-American and older women, compared to other women [24]. These cognitive barriers important for African-American women were addressed in the intervention components.

4.2.2. Interventions on psychological barriers

Interventions on psychological barriers were based on the Basic Stress Model and the Health Behavior Model [25]. The models assume that stressors presented as life event change can lead to physical and psychological morbidity, and impede preventive health behavior. Loss of the spouse is one of the important stressors of depression for the aged, which are usually presented as loneliness, helplessness and hopelessness [26]. As a result of the psychological depression, women without a spouse are less likely to seek preventive screening. Our intervention program targeted improving single women's psychological health and therefore bringing about more motivation for preventive health behavior. Two strategies, coping and social support, were adopted in the interventions.

Coping refers to the cognition and behaviors that control or reduce stressful life circumstances, and moderate the affective arousal usually accompanying stress [26,27]. According to cognitive-behavior theory, people would change their erroneous thoughts when they participate in identifying errors in their thinking, and corrected cognition will alter emotional response from abnormal to normal [28]. Appropriate coping skills, which we taught, was supposed to help women to deal effectively with their emotional problems and to place emphasis on the important demands of their lives [25], such as health screening.

Social support is another important way to decrease psychological problems. Social support can decrease one's stress by changing problematic situations [25], giving more opportunities to discuss problems [25] and sharing concerns. Older single women are especially prone to lack support because lack of spouse leads to weakened support system and fewer communications with others. Therefore, social support may be especially effective for older single women, helping them maintain a positive attitude toward their lives and health. The interventions of this study on social support were directed at both study subjects (to increase their social activities and communications) and their influential others (to increase their support of study subjects).

4.2.3. Interventions on social-network barriers

Besides that in psychology, social support may also play a very important role in overcoming other social-network barriers in screening behavior of older single African-American women. Our intervention component on social support was based on Precede-Proceed Model [22,23], Social Support Theory [29] and the Theory of Reasoned Action [30].

According to Precede-Proceed Model [22,23], there are enabling factors that impede the use of screening procedures, such as immobility or inaccessibility to medical care due to disease, old age, lack of transportation, or economic difficulties among single older women. Support from family members, relatives or friends can materially help older single women with overcoming the barriers in enabling factors.

According to Social Support Theory [29], social support can have positive influences on behavioral change and the maintenance of self-care practices through (1) communicating expectations and positive affect, sense of belonging, and reciprocity, (2) appraising a certain situation as desirable or undesirable, (3) showing empathy, tolerance, and concern, (4) offering general problem-solving assistance, (5) encouraging self-reward and minimizing stress, and (6) providing information and advice. Family members, relatives and close friends are significant for providing such supports to older single women.

According to the Theory of Reasoned Action [30], a person's behavioral intention is determined by his/her attitude and by his/her subjective norm. Subjective norm is referred to as one's perception of what a significant other believes concerning performance of the behavior and one's motivation to comply with the significant other's perceived beliefs. Therefore, advice from significant others would be influential for a woman's screening behavior.

Studies have shown that intention to have a mammogram is positively related to the influence of significant others [30], and women are twice more likely to have a mammogram if they get a recommendation from their friends [31]. The same effects were supposed to be

achieved in our study by increasing social support to older single women.

4.3. Intervention strategies

To link the theoretical bases on the three intervention components to our intervention activities, we integrated each theoretical element into our intervention program. To maximize the effects of the intervention program, we executed the interventions not only on subjects themselves but also on their significant others identified by the subjects at pre-intervention measurement. For example, we taught subjects overcome cognitive barriers on breast cancer screening. On the other hand, we educated the significant others about the benefit of breast cancer screening and asked them convey the knowledge to the subjects. Also, we not only asked significant others to provide emotional, material and informative support to subjects, but also advised subjects of seeking help from their significant others. Therefore, any benefits from the interventions for study women might result from the direct effects on the women and the indirect effects through the interventions on their significant others.

4.4. Intervention instruments

4.4.1. Appropriateness of intervention instruments

All intervention instruments were designed to be culturally appropriate. The cultural appropriateness was embodied in (1) addressing problems and needs in health among African-American women, (2) using words and graphs that are relevant to African-Americans, and (3) using African-American role models in all print and “live” messages.

Appropriateness for old age and low income was also addressed. Because study subjects might have vision problem and low education level due to old age and low income, printed educational materials compensated for these characteristics of older women. Text in printed materials were brief, and easy to understand, with a large and clear typeface. Graphics in the materials were realistic and reflect lives of older African-American women. Considering possibly low reading ability of study subjects, we used graphs where possible that were designed to be understandable to illiterate women.

Intervention instruments were also appropriate for single marital status. According to psychological features of single women, all graphics in printed educational materials did not contain figures of a couple. The printed educational materials were designed to be bright and luminous.

4.4.2. Content of intervention instruments

Three educational brochures were used for interventions on study women. The first brochure aimed to increase women's cognition about breast screening procedures. We addressed (1) susceptibility of women to breast cancer, (2) the importance of early detection of breast cancer, (3) the effectiveness of mammography and clinical breast examination in the early detection of the disease, (4) the safety of mammography procedure (radiation exposure), (5) unnecessary concerns of discomfort about the procedures, and (6) availability of breast screening procedures. The second brochure taught women the skills in psychological adjustment. We addressed (1) cognitive self-control (countering automatic thoughts and altering negative thoughts) [28,32], (2) emotion

self-control (paying attention to activities that can relieve awareness of problematic circumstances or tensions) [25], (3) the value of social activities, friends, and a support system [28,32], and (4) goal setting, including time planning [28,33]. In each brochure, we provided a toll-free telephone number for women to ask questions on breast cancer screening or psychological adjustment when they need.

Printed educational materials on interventions on the significant others of study women included a cover letter, a brochure, and a contract form that were mailed to the significant others. The cover letter stated our study purposes and their role in helping the study woman. The brochure taught the significant others what they could do for helping the study woman, such as providing health information, reducing psychological depression, advising a breast cancer screening, and providing transportation or other helps that the woman might need for a screening. The significant others were asked to sign an enclosed contract if they could provide.

Didactics and modeling covered the same content of brochures, addressing susceptibility and seriousness of breast cancer, knowledge and benefits of breast cancer screening, psychological self-control and importance of social network and support.

4.5. Lay health educators

4.5.1. Recruitment of lay health educators

Previous studies have shown that study subjects may feel more comfortable when health educators share similar cultural patterns, values, and experience [34], and that familiarity to and

trust by the target population is the key for gaining access to the target population and obtaining greater effects of an intervention program [35]. Therefore, lay health educators from the target populations were used to deliver the educational interventions to study women.

A lay health educator was an African-American woman from the same housing complex where possible and at age as close as possible to the study women. An eligible woman who would work as a lay health educator signed a contract with the principal investigator, and subsequently worked among women from the housing complex where she lived.

4.5.2. Training of lay health educators

Lay health educators of this study attended four 3-hour training sessions. Session 1 involved the basic knowledge of breast cancer including pathogenesis, natural history, and epidemiology of the diseases, and knowledge of breast cancer screening procedures and their benefits. Session 2 talked about barriers to the screening procedures, and how to implement education by using didactic and modeling techniques. Session 3 covered psychological characteristics of single women, psychological adjustment, and how to perform psychological education using didactic and role-modeling skills. Session 4 gave lay health educators an opportunity to practice the skills they have learned and to perform interventions in a simulated situation. The first two hours of each session were used for teaching, and the third hour was the time for questions and discussions. Important issues were stressed, repeated and summarized during training. At the end of each session, a short test were given to the session attendants to ensure that they had learnt what had been taught in the session.

4.6. Implementation of interventions

4.6.1. Interventions on study subjects

The lay health educator taught the subject knowledge on breast cancer screening and psychological adjustment. Lay health educators imitated scenes where a barrier or emotional problem might exist, and taught subjects how to overcome the barrier or problem. At the end of interventions, important points were repeated in order to improve learning, and the brochures was given to the woman so that she could review them later.

To evaluate the quality of the intervention execution, the interviewer watched the lay health educator's performance during the intervention and completed an evaluation form at the end of the intervention.

4.6.2. Interventions on the significant others

Three significant others (family members, relatives and close friends) living in the surrounding areas, identified from the pre-intervention questionnaire completed by a study woman, were subjects of the interventions. As aforementioned, we mailed educational materials to the significant others for their help for study women. The significant others were asked to sign on a contract with the principal investigator for their promise of help, and return the completed contract using an enclosed pre-stamped envelop.

5. Data Analysis

We evaluated the intervention program at two time points (post-intervention and follow-up) and using three methods. First, we compared the intervention group with the control group at post-intervention or follow-up in prevalence of breast screening procedure conducted in the preceding year. Second, we calculated the changes in mean response between two time points (pre-intervention vs. post-intervention and post-intervention vs. follow-up) and the changes were compared between the two groups. Third, we used mixed model regression approach to evaluate the intervention program with adjustment of potential confounding variables.

The prevalence of breast screening procedure was calculated for the intervention and control groups, respectively. The prevalence was the average of the frequencies of a breast screening procedure conducted in the preceding year within the group and was calculated for post-intervention and follow-up data respectively. We also created a compound variable that incorporated all three screening procedures. We first calculated a z-score (dividing the average prevalence by its standard error) for each of the screening variables and then added z-scores of the three procedures in each group. The prevalence rates or total z-scores at post-intervention or follow-up were compared between the two groups using the permutation test [36].

The changes in mean response from pre-intervention to post-intervention and from post-intervention to follow-up were calculated for breast screening procedures and variables in attitude/knowledge/beliefs. We also calculated the changes in z-scores for screening variables. The permutation test was used to examine whether there were differences between the two groups in the changes.

In this study, housing complexes were the units of randomization which were allocated to either intervention or control groups and study women living in these housing complexes were interviewed at pre-intervention, post-intervention and follow-up. Mixed model regression analysis is an ideal approach that can be used for community-based assignment and repeated measurements [37,38]. Specifically, we used generalized linear mixed model that does not require the assumption of normal error structure. The following is the model:

$$Y_{ilm} = \beta + G_i + H_l + S_{ml}$$

Where Y_{ilm} is the change between two time points (pre-intervention vs. post-intervention or post-intervention vs. follow-up) in the response of individual m within housing complex l and group i . G_i represents study group (intervention vs. control), H_l is housing complex within study group, and S_{ml} stands for study subject within housing complex. Covariates were adjusted in the model.

The presentation of an intervention effect due to the study group is the primary interest for assessing the effectiveness of the intervention program. A significant G_i indicates that the change in the intervention group is different from that in the control group during the study period.

In this report, we present our results based on the preliminary analyses, in which the use of breast cancer screening and knowledge/attitudes/beliefs were the outcomes of interest. Only demographic variables and the potential effects of other educational activities on breast health were adjusted in mixed model regression analyses. We used all study subjects in the analyses. We also repeated our analyses for each screening procedure using study subjects who did not use

the corresponding procedure in the preceding year (non-compliers). The latter was used to show if the frequencies of breast screening were different between the two groups among non-compliers after the intervention.

Results

Table 1 shows the demographic characteristics of women in the intervention and control groups. Women in the intervention group tended to be younger, were more likely to have had education of high school or higher, and were less likely to have a household income less than \$5,000, compared with those in the control group. The distribution in marital status and religious preference was similar between the two groups.

The use of breast cancer screening was assessed one year after the intervention (post-intervention) and one year after post-intervention interviews (follow-up). At the post-intervention assessment, seventy-two percent of women in the intervention group had ever had a clinical breast examination in the preceding year and the corresponding frequency was 59 percent in the control group during the same period. No differences were found between the two groups in mammography use and breast self-examination at the post-intervention assessment. At the follow-up assessment, women in the intervention and control housing complexes were similar in the use of any of the three screening procedures in the preceding year.

Table 3 shows the differences between the intervention and control groups in the change in breast screening frequency or the mean level of knowledge/attitudes/beliefs between pre-

intervention and post-intervention assessments and between post-intervention and follow-up interviews. The intervention group tended to have greater increase in clinical breast examination from the pre-intervention time point to post-intervention point, compared with the control group. The similar tendency was shown when the compound variable incorporating all three screening procedures was used. However, no material differences were demonstrated for mammography use or breast self-examination themselves as an independent measure. The change generally was not different between the two groups in the mean level of knowledge/attitudes/beliefs variables, except that, at the post-intervention assessment, women in the control group seemed more likely to disagree on that a woman does not need to have a mammogram unless she gets a breast problem. When the changes from the post-intervention assessment to the follow-up assessment were compared, the control women seemed to have greater increase in the use of screening procedures as shown in the compound variable. No differences were substantial between the intervention and control groups in the change in knowledge/attitudes/beliefs on breast health.

To control for the potential effects of demographic variables and knowledge from other sources during the study period, we conducted mixed model regression analysis to compare the intervention and control groups in the change of variables in breast screening and knowledge/attitudes/beliefs. Women who received the intervention tended to have had a great increase in getting a clinical breast examination in the year prior to the post-intervention survey than those who did not. However, such tendency disappeared from the post-intervention assessment to the follow-up assessment. The similar results were shown for mammography. However, the control women were more likely to increase the use of breast self-examination especially for the period from the post-intervention assessment to the follow-up assessment. Women in the intervention group were more likely to recognize the usefulness of mammograms at

the post-intervention assessment while the control women were less likely to be so. However, as shown in the univariate analysis, women in the control group seemed more likely to disagree on that a woman does not need to have a mammogram unless she gets a breast problem at the post-intervention assessment. The change generally was not different between the two groups from the post-intervention survey to the follow-up survey in knowledge/attitudes/beliefs variables, except that the change in the control group seemed more favorable in recognizing that women can have breast cancer without symptoms.

The analyses that confined to the women who did not get a breast screening in the preceding year showed the similar results. During the year after the intervention, the non-compliers in the intervention group were more likely to have a clinical breast examination or mammogram than those in the control group. However, they seemed less likely to have a mammogram in the subsequent year.

Discussion

Our preliminary results showed that women in the intervention group seemed more likely to have a clinical breast examination in the year after the intervention and such a possible increase diminished in the second year. A similar tendency might exist for mammography use during the first year after the intervention. The study did not show the overall positive effects of our intervention program on breast self-examination and knowledge/attitudes/beliefs in breast health among older single African-American women. These results, if confirmed by more detailed analyses and more studies, were consistent with the possibility that culturally appropriate intervention programs may change behavior by meeting the beliefs of participants rather than

changing their beliefs [39]. In general, however, our intervention program did not show significant effects, which may attribute to a number of factors.

The insignificant effects might be related to the demographic characteristics of our study subjects. The study women were very old (the mean age was 76 years), lived in public housing complexes, and had low education and low family income. Women at very old age may have less interest in educational activities and poorer memory. Less interest makes women pay less attention to an education program in preventive care and ignore the conveyed information after the delivery of the program. Decreased memory may prevent women from remembering the education delivered to them. The possible improvement in breast examination but not in knowledge/attitudes/beliefs suggest this possibility: women may be able to remember a simple message in getting a breast examination but not more complicated messages in knowledge/attitudes/beliefs. Low education level and low family income might also contribute to less interest in an educational program. Although the women accepted the intervention program, they might not take the intervention content seriously.

Lack of booster sessions of the intervention program might have weakened the effects of the intervention program. Reaching underserved women and mobilizing them toward behavior change can be labor intensive. It is practically infeasible and economically inefficient to deliver to general underserved populations a multifocused intervention with multiple deliveries to the same individual over time. Thus, we intended to have an economically efficient program and delivered it once without any booster sessions. It may turn out that lack of booster sessions might impede the adequate conveyance of the intervention information to the study women. Booster sessions may be particularly important for older single African-American women because they have more

difficulties in comprehending and remembering the delivered information.

Some intervention components turned out not to be very important for the study population. One of the theoretical bases for the intervention program was that older single African-American women may be more likely to have psychological problems and therefore less likely to seek breast screening. As a result of the theoretical basis, we targeted improving the study women's psychological health. However, our pre-intervention data showed that psychological variables were not associated with the use of breast cancer screening procedures among our study subjects. Therefore, our intervention component in psychological aspect might have had no impact on the breast- screening behavior.

Methodologically, there were several factors that might have influenced the results. First, the errors in the measurement of the use of breast screening might be a problem. A study in low-income African-American women showed that only 49-60% of reported mammography could be verified in medical records [40]. Because of limited budget and manpower, we used self-report rather than medical records review for the measurement of breast screening use. If the frequency of the possible inaccuracies was high in our study population, which we are unable to know, the results might have been influenced. Second, the power of the study might not be high. It is known that the study power of community-based intervention studies increases as the number of study communities [41]. Although we had 10 housing complexes available, the study power might not be high if the effects of the intervention program were not strong as shown in the preliminary analyses. Last, loss to follow-up might be another problem. Because of older age and instability of the population, about 9-10% of the study women had died or moved out at the post-intervention and follow-up assessments respectively. If breast cancer screening behavior and

knowledge/attitudes/beliefs were different between these women and those who complied to the study, the study results might be biased. However, such effects might not be very serious since the attrition rates were not very high.

To evaluate our intervention program more thoroughly, more analyses are needed. For example, more factors need to be considered in the adjustment of confounders. Data need to be analyzed according to whether significant others actually helped or agreed to help the study women in terms of what we asked. Effect size of the intervention program might be greater among women whose significant others advised them of getting a breast screening or gave them more support and help. The potential bias due to the non-participation in the post-intervention or follow-up assessment can be assessed by comparing the non-participants and participants, using the pre-intervention data.

KEY RESEARCH ACCOMPLISHMENTS

- Conducted pre-intervention interviews;
- Implemented the interventions on the study women and their significant others;
- Conducted post-intervention interviews;
- Did follow-up interviews;
- Did some data analyses on factors related to breast cancer screening and on the evaluation of the intervention program; and
- Had publications or forthcoming publications and presentations or forthcoming presentations at the national scientific meetings.

REPORTABLE OUTCOMES

Accomplished or forthcoming publications

1. Zhu K, Hunter S, Bernard LJ, Payne-Wilks K, Roland CL, Levine RS. Recruiting elderly African-American women in cancer prevention and control studies: a multifaceted approach and its effectiveness. *J Natl Med Assoc* 2000;92:169-75.
2. Zhu K, Hunter S, Bernard LJ, Payne-Wilks K, Roland CL, Levine RS. Mammography screening in single older African-American women: a study of related factors. *Ethnicity and Disease*, November 2000.

Accomplished or forthcoming presentations

1. Zhu K, Hunter S, Payne-Wilks K, Roland CL, Gu Y, Levine RS, Bernard LJ. Cognitive, psychological, social and medical care factors in mammography screening in single older African-American women. *Ann Epidemiol* 1998;8:470.
2. Zhu K, Hunter S, Bernard LJ, Payne-Wilks K, Roland CL, Everett C, Feng Z, Levine RS. An intervention study on screening for breast cancer among single African-American women aged 65 and older. The Annual Meeting of American College of Epidemiology, Atlanta, September, 2000.

2. Lyons E, Zhu K, Hunter S, Bernard LJ, Payne-Wilks, Roland CL, Levine RS. Depression-related variables and breast self-examination in single older African-American women. The Annual Meeting of American College of Epidemiology, Atlanta, September, 2000.

CONCLUSIONS

This project has been successfully completed according to the Statement of Work. We obtained a high initial participation rate (88.6%) of eligible women and high follow-up rates (about 90% for both post-intervention and follow-up assessments). Considering the barriers to enroll African-Americans into a study and the low response rates in some other studies, these participation rates were outstanding. The intervention program was well implemented. Preliminary analyses on the evaluation of the intervention program have been done. We also have had some accomplished or forthcoming publications and presentations. We hope that the results from this project will be helpful for future studies.

The completion of this project could not be made without the collective efforts of our research team, the resident association coordinator of MDHA, lay health educators and study helpers. These efforts are deeply appreciated. We are also very grateful to the Department of Defense for the funding that made this project possible.

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APPENDICES

Table 1. Demographic characteristics of older single African-American women in the intervention and control groups, Nashville, Tennessee, 1997

Variable	Intervention		Control
		group (%)	group (%)
Age (year)	65-69	52 (32.1)	39 (24.1)
	70-74	47 (29.0)	31 (19.1)
	75-79	25 (15.4)	33 (20.4)
	80-84	21 (13.0)	33 (20.4)
	>=85	17 (10.5)	26 (16.0)
Ever married or lived as married	No	17 (10.5)	17 (10.5)
	Yes	145 (89.5)	145 (89.5)
Marital status in past year	Separated	17 (10.5)	15 (9.3)
	Divorced	24 (14.8)	20 (12.3)
	Widowed	102 (63.0)	109 (67.3)
	Never married	19 (11.7)	18 (11.1)
Educational level	No schooling or elementary school	18 (11.1)	22 (13.5)
	Middle school	46 (28.4)	66 (40.7)
	High school	78 (48.1)	56 (34.6)
	Vocational or technical training school	4 (2.5)	5 (3.1)
	Some college	10 (6.2)	7 (4.3)
	College or higher	3 (1.9)	2 (1.2)
	Other	2 (1.2)	2 (1.2)
Household income in past year	<\$5,000	76 (46.9)	99 (61.1)
	\$5,000-\$9,999	61 (37.7)	52 (32.1)
	\$10,000-\$14,999	5 (3.1)	2 (1.2)
	Do not know	20 (12.3)	9 (5.6)
Religion	Protestant	150 (93.2)	152 (93.8)
	Catholic	1 (0.6)	1 (0.6)
	Latter Day Saint	1 (0.6)	1 (0.6)
	Other	8 (5.0)	7 (4.3)
	None	1 (0.6)	1 (0.6)

Table 2. Post-intervention and follow-up surveys of breast cancer screening use in the preceding year among older single African-American women in the intervention and control groups, Nashville, Tennessee

Screening procedure	Group	Post-intervention		Follow-up	
		Mean	p-value	Mean	p-value
Clinical breast exam	Intervention	0.72		0.70	
	Control	0.59		0.67	0.60
Breast self-exam	Intervention	0.81		0.78	
	Control	0.80		0.83	0.53
Mammography	Intervention	0.55		0.66	
	Control	0.53		0.68	
			0.81		0.78

Table 3. Changes in breast cancer screening use or knowledge/attitudes/beliefs in breast health between pre-intervention assessment, post-intervention assessment and follow-up assessment among older single African-American women, Nashville, Tennessee

Variable	Difference between intervention and control groups in the change			
	Pre-intervention vs. post-intervention		Post-intervention vs. follow-up	
		p-value		p-value
Clinical breast exam	0.10	0.14	-0.09	0.32
Mammography	0.06	0.37	-0.03	0.75
Breast self-exam	0.02	0.52	-0.05	0.42
Concern about the cost of a mammogram	-0.09	0.52	0.22	0.47
Worry about radiation	0.06	0.67	-0.08	0.57
Discomfort with mammography machine	-0.15	0.46	-0.08	0.59
Fear of cancer	-0.07	0.75	0.02	0.94
Mentioned concerns stop having a mammogram	0.04	0.16	-0.03	0.33
Other concerns stop having a mammogram	-0.03	0.52	-0.03	0.57
Likelihood to have a mammogram next year	-0.02	0.87	-0.04	0.84
Mammograms are useful	-0.09	0.30	0.01	0.88
Do not need a mammogram	-0.17	0.11	-0.08	0.63
Can have breast cancer without symptoms	-0.02	0.90	0.02	0.94
Breast cancer can be cured	-0.04	0.63	-0.06	0.57
Looking for breast cancer makes women worry	0.01	0.79	0.12	0.56
Treatment is worse than breast cancer itself	-0.06	0.77	0.06	0.59
Operation cause cancer to spread	-0.06	0.63	0.02	0.87
Z-change	3.65	0.21	-3.44	0.24

Table 4. Mixed model regression analysis for change in breast cancer screening use or knowledge/attitudes/beliefs in breast health between pre-intervention assessment and post-intervention or follow-up assessment among older single African-American women, Nashville, Tennessee

Variable	Difference between intervention and control groups			
	Change from pre-intervention to post-intervention		Change from post-intervention to follow-up	
	Coefficient*	p-value	Coefficient*	p-value
Clinical breast exam	0.59	0.18	-0.17	0.62
Mammography	0.33	0.46	0.00	0.99
Breast self-exam	-0.15	0.76	-0.45	0.24
Concern about the cost of a mammogram	-0.06	0.74	0.05	0.79
Worry about radiation	-0.01	0.96	-0.06	0.76
Discomfort with mammography machine	-0.18	0.38	-0.08	0.66
Fear of cancer	0.03	0.87	-0.09	0.70
Likelihood to have a mammogram next year	0.05	0.81	-0.06	0.86
Mammograms are useful	-0.18	0.12	0.08	0.67
Do not need a mammogram	-0.19	0.17	0.11	0.52
Can have breast cancer without symptoms	-0.13	0.46	0.19	0.18
Breast cancer can be cured	-0.06	0.58	0.08	0.48
Looking for breast cancer makes women worry	0.03	0.82	0.18	0.30
Treatment is worse than breast cancer itself	0.03	0.84	0.09	0.63
Operation cause cancer to spread	0.04	0.79	0.05	0.73

* Adjusted for age, marital status, education, having heard about breast examination through media or from family members/relatives/friends in the preceding year, having attended an organization meeting or received educational materials on breast cancer in the preceding year, and whether what heard makes it more likely to get a breast examination.

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Meeting abstracts

1. Zhu K, Hunter S, Payne-Wilks K, Roland CL, Gu Y, Levine RS, Bernard LJ. Cognitive, psychological, social and medical care factors in mammography screening in single older African-American women. *Ann Epidemiol* 1998;8:470.
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